The Westland Corporation

PROCESSOR

MEASURE TO MANAGE

Dave Larson
President


Dave Larson

High reject rates, short shots and downtime can really raise the frustration level. All can get your blood boiling as they can be symptoms of issues in a process.

Now consider this. At an annual physical, one of the first vital signs checked by a doctor is blood pressure. Basically, blood pressure measures the pressure of the blood against the walls of the arteries. The heart uses force to continually pump the blood throughout the body. If that force gets high enough, it may eventually lead to problematic health issues.

... how are you going to control your high blood pressure if you don't know you have it?

The weird thing about blood pressure is that it can be present for years without any symptoms. However, real damage can be done during that time. The good news is that once discovered, high blood pressure can usually be controlled.

Now for the disclaimer … I am not a medical doctor nor do I hold any special training in the science of medicine. However I do believe it is important to check your blood pressure on a regular basis and encourage you do to so. Why? Because, how are you going to control your high blood pressure if you don't know you have it? In order to manage it, you have to measure it.

I state this simplistic approach to blood pressure as an analogy of a molding process. Without routine checking for wear on screws and cylinders, real damage can occur to those components. Running a worn screw and cylinder beyond the point of repair can really eat into profits.

Just as no one likes to go to the doctor, performing routine maintenance is usually not at the top of the list of favorite activities.

However, as with discovering high blood pressure, wear discovered during routine maintenance can be a warning sign of impending problems with your equipment. And, there might be options available to minimize that wear.

In this issue, we focus on preventive maintenance while discussing the different types of wear that may be encountered. In the next issue of the Westland Processor, we will discuss the measurement of processing variables.

Have you found wear in any of your components? Send it to Westland. Our incoming inspectors will thoroughly examine it and provide options for repairing and/or replacing. Contact one of our sales engineers today at 800-247-1144 to learn more.

DO YOU KNOW ...

The American Heart Association reports that one in every three Americans has high blood pressure (HBP). The instruments used to manually measure HBP are a "sphygmomanometer" (pronounced sfig·mo·ma·nom·e·ter) and a stethoscope. With the sphygmomanometer cuff inflated with air, a stethoscope is placed over an artery in the crook of the arm. As the air in the cuff is released, the first sound heard through the stethoscope marks the systolic pressure (the top number). As the release of air from the cuff continues, the sound fades. The point at which the sound disappears marks the diastolic pressure (the bottom number).

Do you know what mammal has the highest blood pressure? Answer Inside

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MADE IN THE USA
High Performance Screws and Cylinders

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David Brinkmeyer (kneeling second from the right) with other members of the Plastics Advisory Council of Pittsburg State University.

DAVID BRINKMEYER JOINS WESTLAND CORPORATION

David Brinkmeyer has joined Westland Corporation as a Senior Process and Sales Engineer. David brings with him an extensive background in the plastics industry. He is an alumnus of Pittsburg State University in Pittsburg, Kansas, having received a minor in Engineering Technology through their Plastics Engineering Technology program. David also sits on the University's Plastic Advisory Board.

David's experience as a process engineer in the field has already proven to be an asset in helping our customers. Please call him today with any quote requests, for information on our products and services or with process questions. You will find him very knowledgeable and eager to help.

Terry Hackney (shown between Dave Larson on the left and Dan Johnson on the right) with 10 year recognition award.

TERRY HACKNEY RECIEVES TEN YEAR AWARD

Terry Hackney was recently honored for 10 years of service at Westland. Terry is a screw CNC machinist. His attention to detail is another reason Westland can confidently say "Our People Make The Difference". Thank you Terry!

Answer to Do You Know: The giraffe. Read all about the true nature of the giraffe heart and cardiovascular system at the BBC Earth News cite: http://news.bbc.co.uk/earth/hi/earth_news/newsid_8368000/8368915.stm

MEASURING AND MANAGING

PART 1

Understanding How Wear Affects Your Process

It has been said "If you can't measure it - you can't manage it". To remain productive and efficient, guidelines to measure performance must be established. Plastic processing is a science and there are reasons why certain behaviors are experienced. In production there are several variables that, when measured, can help processors understand the results generated on certain jobs. Westland encourages a strong preventative maintenance (PM) program to help understand why a process may change over time due to screw, barrel and/or valve wear.

Understanding Types Of Wear

The clearance between the screw and barrel can change the rate and the way (conductive versus mechanical) that heat is applied to the resin plus alter where in the process the resin transitions from solid to melt.

When a screw and barrel are evaluated, it is important to be able to understand the type(s) of wear taking place and what caused it. The three (3) basic types of wear encountered on screws, barrels and valves are:

(1) <u>Adhesive wear</u> – metal to metal contact (typically contact of O.D of the screw and/or valve into I.D of the barrel).

(2) <u>Abrasive wear</u> – particle to metal contact of reinforcement materials.

(3) <u>Corrosive wear</u> – chemical to metal contact from a corrosive environment.

Knowing and measuring the types of wear will provide information necessary to develop the proper screw design for the resins being processed, all in an effort to maintain an isothermal and homogeneous melt quality.

All resins are melted by using pressure, time and temperature. These parameters can be manipulated; however, at a certain point in the process of manipulation, the quality of the resin can be sacrificed, which may lead to increased rejects. (Learn more about different melting characteristics in Volume 7-Issue 2 of the Westland Processor.)

Variables That Can Cause Wear

Wear changes a process and can force variances in baseline machine settings in order to maintain an isothermal and homogeneous melt quality. The following variables can cause all three types of wear:

<u>Compatibility</u> - If the screw, barrel and valve are manufactured from material not compatible to the resin being processed, premature wear will occur.

Process and Heat Profiles - A residence time is established by the process to melt the resin. Too long or too short of a residence time can result in excessive wear on the screw, barrel and valve. It is critical to know how heats are set for the given residence time. Residence time is based on the resin inventoried in the screw, cycle time and shot size being run. All resins transition from a solid to molten state over a certain pressure, time and heat as designed by the manufacturer. As the provided guidelines are followed in the melting of the resin, the less opportunity there is for blockage or an obstruction to develop. When it does occur, feed pressure then develops on the back of the blockage or obstruction pushing the screw into the barrel. This is commonly called side loading. This action can create adhesive, abrasive and maybe even corrosive wear on the screw or valve and I.D of the barrel.

Inadequate Screw Design - If the screw is not designed for the specific resin being processed, blockages again can develop causing side loading of the screw. This in turn produces hot sectors on the screw which causes the molecular weight and viscosities to change from shot to shot.

Start Up and Shut Down Procedures – In the motor of a car, the most wear takes place from start up. Before starting a motor, all the lubricant has drained to the oil pan. The mechanical parts are not lubricated until the oil begins moving throughout the engine after starting it.

Compare that to the start up on a molding machine. The resin is what centers the screw in the barrel. When a molding machine is started, there is no resin centering the screw which means the screw can be pushed (sometimes at great force) into the I.D of the barrel causing wear. One option to minimize this action is starting the machine with low RPM (15 – 20) until the screw is packed with resin as evidenced by it coming out of the nozzle. Once the screw and barrel are full, the RPM can be increased to the original settings. This helps minimize the contact pressure of the screw into the I.D of the barrel and helps lubricate the O.D of the screw and valve. The resin acts as a lubricant to minimize the metals adhering to each other, helping to prevent adhesive wear.

Most resins become corrosive if left at process temperatures for long periods of time or if exposed to elevated temperatures in the process. Under these conditions, reinforced resins can segregate the reinforcement from the resin (Continued on page 4)

SCREW - BARREL CLEARANCE TABLE

Bore Diameter (Inch)	Avg. Max. Clearance (Inch)	Avg. Min. Clearance (Inch)	Repair/Repl Clearance (Inch)
30 (1 1/4”)	.009”	.006”	.015”
35 (1 3/8”)	.010”	.006”	.016”
40 (1 1/2”)	.010”	.006”	.016”
45 (1 3/4”)	.010”	.006”	.016”
50 (2”)	.010”	.006”	.016”
55 (2 1/4”)	.011”	.007”	.018”
60 (2 3/8”)	.011”	.007”	.018”
65 (2 1/2”)	.011”	.007”	.018”
70 (3”)	.012”	.008”	.020”
75 (3”)	.012”	.008”	.020”
80 (-)	.012”	.008”	.020”
-- (3 1/4”)	.013”	.009”	.022”
90 (3 1/2”)	.014”	.010”	.024”
100 (4”)	.015”	.011”	.026”
105 (4 1/4”)	.016”	.012”	.028”
115 (4 1/2”)	.017”	.013”	.030”
125 (-)	.017”	.013”	.030”
-- (5 1/4”)	.018”	.014”	.032”
135 (-)	.018”	.014”	.032”
155 (6”)	.018”	.014”	.032”

Westland has studied the maximum clearance dimensions specified by six injection molding machine manufacturers and have calculated an average of the clearance for various barrel bore diameters. Those maximum clearances are listed above. If the tolerances specified in these guidelines were applied (for both barrel and screw), the minimum clearances, as shown above, would result. Westland’s suggested guideline for repair/replace is: “If the combined wear of the barrel and screw is twice the normal OEM clearance, the barrel or screw (or both) should be repaired or replaced”.

SAME MACHINE … DIFFERENT RESULTS

Issue: Two identical model molding machines from the same manufacturer; both have the same injection unit and screw diameter, but the process is running completely different from one machine to the next.

What To Look For: An examination of the following items may produce an understanding of this phenomenon.

(1) Do both machines have the same screw design?
(2) Does one machine have more wear in the screw, barrel and/or valve than the other?
(3) Are the same types of heater bands with the same watts per square inch being used on both machines and are all functioning correctly?
(4) Is the same valve assembly in both machines?

These are all variables that can be measured and a PM program will verify.

(Continued from page 3) causing abrasive wear. This environment will shorten the life of a screw, barrel and valve. Reinforced resins should be purged out at shut down with a non-filled resin to remove the reinforcement from the system.

PREVENTIVE MAINTENANCE PROGRAMS

It is an obvious advantage to have procedures in place to recognize wear before machine failure. When it is known how long a screw should last in a given process, steps can be taken to make sure repairs or replacements can be made in a timely manner to reduce or eliminate downtime. Understanding the wear on a component also provides the opportunity to make design changes so that replacements will run longer.

PM programs provide the opportunity to track component wear life and help explain variations experienced in a process over time. As components wear, most likely changes will be seen in one or more of the following areas:

(1) Overall cycle times (standards)
(2) Scrap rates
(3) Electric consumption
(4) Downtime

Any variance in the standards set on these points can be directly related to wear on components. A strong PM program can minimize each of these.

A structured, disciplined PM program will measure the life of the screw, barrel and valve for the resins being processed. Every PM program should include educating employees to understand the different types of wear and the causes of that wear, plus instructions for measuring wear and guidelines for when to repair or replace components. (See chart on pg 3.)

When running mostly reinforced resins, a PM program should be set up for inspecting every six months until wear trends have been established for the screw, barrel and valve.

Non filled resins should be set up on an annual PM until wear trends for the screw, barrel and valve are established.

Westland has put together additional information for developing an effective PM program. Please contact us at 800-247-1144 for a free copy or to discuss establishing the PM program right for your company. The next issue of the Processor will feature the second part of Measuring and Managing as it pertains to variables of a process. Until then, the question is: “if you can’t measure it … can you manage it”?

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